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**THE IMPACT OF POPULATION, AFFLUENCE AND TECHNOLOGY ON THE ENVIRONMENTAL  
DEGRADATION: EVIDENCE FROM HETEROGENEOUS INCOME PANELS**



**DOCTOR OF PHILOSOPHY**

**UNIVERSITI UTARA MALAYSIA**

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**THE IMPACT OF POPULATION, AFFLUENCE AND TECHNOLOGY ON THE ENVIRONMENTAL  
DEGRADATION: EVIDENCE FROM HETEROGENEOUS INCOME PANELS**

**By**

**MUHAMMAD HASEEB**



**Thesis Submitted to**

**Othman Yeap Abdullah Graduate School of Business,**

**Universiti Utara Malaysia,**

**in Fulfilment of the Requirement for the Degree of Doctor of Philosophy**



**Kolej Perniagaan**  
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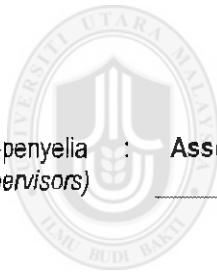
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## ABSTRACT

Efficient utilization of scarce resources is always the prime aim of every state to ensure social welfare, while maintaining clean and green environment to sustainable development. The growing threats of global warming and climate changes have called for more sensible attention of the policy makers. Therefore, this study is an attempt to empirically investigate the linkages between population, affluence, technology, and environmental degradation for selected low, lower middle, upper middle, and high-income countries using disaggregate and aggregate panel data over the period 1980-2015. After checking the stationary properties of the data, Pedroni (1999) tests of cointegration were implemented for cointegration purposes. The FMOLS was employed for parameters estimation. The results show that population, nonrenewable energy consumption, urbanization, population growth, international trade and total energy consumption are the main culprits of CO<sub>2</sub> emissions in all selected panels whereas renewable energy consumption is found helpful in curbing the amount of CO<sub>2</sub> emissions. In addition, GDP growth, FDI and financial development are found having insignificant relationship with CO<sub>2</sub> emissions. Finally, results of Granger causality suggest that the population size, population density and urbanization are usually granger causes of CO<sub>2</sub> emissions. The findings of the study suggest important policy implications. This study recommends scientific planning for urban development, developing environmental awareness among urban residents, encouraging the adoption of more fuel-efficient vehicles, increasing the entire costs of private transport as a few measures to lower the energy consumption and CO<sub>2</sub> emissions. Furthermore, it is advised that policymakers should regulate such policies to trigger international trade activities as international trade detracts CO<sub>2</sub> emissions. In this regard, exploring the alternative energy policies, such as developing energy conservation strategies, decreasing the energy intensity, increasing the energy efficiency, and increasing the utilization of cleaner energy sources can prove better strategies to handle this issue.

Keywords: Population, Affluence, Technology, CO<sub>2</sub> emissions, Sustainable Development

## ABSTRAK

Kecekapan penggunaan daripada sumber yang terhad adalah sentiasa menjadi matlamat utama di setiap peringkat bagi memastikan kebajikan sosial, di samping mengekalkan persekitaran yang bersih dan hijau untuk pembangunan lestari. Ancaman yang semakin meningkat daripada pemanasan dan perubahan iklim global meminta perhatian yang lebih bijak dari pembuat dasar. Oleh itu, kajian ini mencuba untuk menyiasat hubungan secara empirik antara populasi, afluen, teknologi, dan degradasi alam sekitar bagi negara-negara berpendapatan rendah, lebih rendah, menengah atas, dan tinggi terpilih dengan menggunakan data panel disagregat dan agregat sepanjang tempoh 1980-2015. Selepas memeriksa ciri-ciri kepegungan data, ujian kointegrasi Pedroni (1999) dilaksanakan untuk tujuan kointegrasi. FMOLS digunakan untuk penganggaran parameter. Keputusan menunjukkan bahawa populasi, penggunaan tenaga yang tidak dapat diperbaharui, perbandaran, pertumbuhan penduduk, perdagangan antarabangsa dan jumlah penggunaan tenaga merupakan penyebab utama pelepasan CO<sub>2</sub> dalam semua panel yang terpilih manakala penggunaan tenaga yang dapat diperbaharui didapati membantu dalam membendung jumlah pelepasan CO<sub>2</sub>. Di samping itu, pertumbuhan KDNK, FDI dan kemajuan kewangan didapati mempunyai hubungan signifikan dengan pelepasan CO<sub>2</sub>. Akhirnya, keputusan daripada hubungan sebab dan akibat Granger mencadangkan bahawa saiz penduduk, kepadatan penduduk dan pembedaan biasanya penyebab pelepasan CO<sub>2</sub>. Dapatan kajian menunjukkan implikasi dasar yang penting. Kajian ini mencadangkan perancangan saintifik untuk pembangunan bandar, membangunkan kesedaran alam sekitar dalam kalangan penduduk bandar, menggalakkan penggunaan kenderaan bahan api yang lebih cekap, meningkatkan keseluruhan kos pengangkutan swasta sebagai ukuran untuk mengurangkan penggunaan tenaga dan pelepasan CO<sub>2</sub>. Selanjutnya, pembuat dasar dinasihatkan melaksanakan dasar-dasar untuk mencetuskan aktiviti perdagangan antarabangsa sebagai perdagangan antarabangsa yang mengurangkan pelepasan CO<sub>2</sub>. Dalam hal ini, meneroka dasar tenaga alternatif, seperti membangunkan strategi pemuliharaan energi, mengurangkan intensiti tenaga, meningkatkan kecekapan tenaga, dan meningkatkan penggunaan sumber tenaga yang lebih bersih membuktikan strategi yang lebih baik untuk menangani isu ini.

Kata Kunci: Populasi, Afluen, Teknologi, Pelepasan CO<sub>2</sub>, Pembangunan Lestari



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## LIST OF ABBREVIATIONS

|                 |  |
|-----------------|--|
| AIC             | Akaike's Information Criterion   |
| ARDL            | Autoregressive Distributed Lag   |
| ASEAN           | Association of South East Asian Nations                                |
| BRICS           | Brazil, Russia, India, China and South Africa                          |
| Btu             | Quadrillion British Thermal Unites                                     |
| CCR             | Canonical Cointegration Regression                                     |
| CO <sub>2</sub> | Carbon Dioxide   |
| DOLS            | Dynamic Ordinary Least Square  |
| ECT             | Error Correction Term  |
| EKC             | Environmental Kuznets Curve  |
| EU              | European Union   |
| FDI             | Foreign Direct Investment  |
| FEM             | Fixed Effects Model  |
| FMOLS           | Fully Modified Ordinary Least Square                                   |
| GDP             | Gross Domestic Product   |
| GHGs            | Greenhouse Gases   |
| GMCI            | Global Manufacturing Competitiveness Index (GMCI)                      |
| GMM             | Generalized Method of Moments  |
| GNP             | Gross Domestic Product   |
| IAA             | Innovative Accounting Approach   |
| IEA             | International Energy Agency  |
| IPCC            | Intergovernmental Panel on Climate Change                              |
| JML             | Johansen Maximum Likelihood  |
| MENA            | Middle East and North Africa   |
| MNCs            | Multinational Companies  |
| OCED            | Organization for Economic Co-operation and Development                 |
| PHH             | Pollution Heaven Hypothesis  |
| PLS             | Partial Least Square   |
| R&D             | Research and Development   |
| REM             | Random Effects Model   |
| SO <sub>2</sub> | Sulfur dioxide   |
| STRIPAT         | Stochastic Impacts by Regression Population, Affluence, and Technology |
| TY              | Toda Yamamoto  |
| UAE             | United Arab Emirates   |
| UN              | United Nation  |
| US              | United States  |
| VECM            | Vector Error Correction Model  |
| WEF             | World Economic Forum   |
| 2SLS            | Two-stage Least Square   |
| 3SLS            | Three-Stage Least Square   |

## CHAPTER 1

### INTRODUCTION

Chapter 1 begins with the introduction and background of the study in Section 1.1. The problem of the study is stated in Section 1.2. The research questions and objectives are provided in Section 1.3 and Section 1.4, respectively. The significance of the study is discussed in Section 1.5 followed by the scope of the study under Section 1.6. The structure of the study is presented in Section 1.7. Finally, Section 1.8 provides the conclusion of the chapter.

#### 1.1 Background of the Study

The increasing global warming threatens, and climate changes have called for more attention and discussion of global environmental issues. An increase in air and ocean temperatures leads to melting of snow and rising of average sea level are unambiguous evidences of global warming. Intergovernmental panel on climate change (IPCC) has predicted that by the year 2100, there would be a possible increase of 1.1<sup>o</sup>C to 6.4<sup>o</sup>C in global temperature and a rise of 16.5cm to 53.8cm in sea level (IPCC, 2013).

In this context, it will not be an exaggeration to mention that Greenhouse Gases (GHGs) emissions is the main cause of global warming and GHGs result primary from the combustion of fossil fuels. The fossil fuels come from the non-renewable sources like oil, coal and gas and contribute mainly in the CO<sub>2</sub> emissions. The world CO<sub>2</sub> emissions show



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